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F 11

Of Seeing

To do justice to ~~the Physiology~~ this subject, would require a whole course of lectures. — The mathematician & natural philosopher has each in his turn made the theory ~~as~~ of Vision the subject of investigation and controversy. [I shall only mention these controversies, and confine myself to that detail of facts & principles which should be previously known by a Student of Medicine before he can understand the Pathology of the eye ~~the objects of the Science~~ of Seeing. —

This ~~Science~~ important

V Insects are possessed of a number of eyes to defend them from the injuries from all causes to which from their weakness they are constantly exposed.

Vision is nearly universal. Few animals ~~exist~~ have it without it. It exists in the highest degree in birds - next in man - then in the ape - in certain quadrupeds, & descends gradually to reptiles, insects - and fish.

The size of the eye is in an inverse proportion to the size of Animals - It is least in the Whale the Rhinoceros, & the Elephant, & largest in proportion to the size of their bodies. birds & insects. The eyes are placed in the human body =

of a Cat, highly gra[illegible]

Sense
is committed to two distinct organs,
alike in
every respect in their structure, and
uses. They serve from their number to
impart beauty & symmetry to the face, &
to prevent the extinction of vision by the
loss of either of them. It is remarkable that no animal possesses an odd number or but one eye of eyes. they all have 2. 4. 6. & 8 & more. in the most suitable
part of the head to perform in the human species, the office
assigned to them. They are lodged in the
cavity of a bone to defend them
from injuries – and eye brows – eye
lids – and eye lashes all concur to

V The Structure of the eye lids, as being the
seat of veneral diseases merits our parti=
=cular attention. They consist of six coats.
1 The Cuticle which peels off after
recovery from the Erisepelas. 2 the true
Skin. 3 the Cellular membrane. This
this coat sometimes swells in the small pox &
in Erisepelas to the thickness of an inch.
It is sometimes swelled in a Dropsy.
It is remarkable that in the fattest persons
there is never any fat in this membrane.
4 the muscular expansion of the elevator
muscle of the eye. 5 a Stratum of papillæ.
6 a fine membrane which lies next to
the eye - full of small vessels visible upon
elevating the eyelids. By means of these mu=
=scous membranes, the eyelids are
elevated & depressed without any [illegible]

protect the eye from too much light - ~~from~~ from the sweat which distils from the brows ~~in labor.~~ in labor. ~~and protects the lids and prevents the fall of the~~ ~~lashes~~ also from insects - and the par=
=ticles of dust which float at all times
more or less in the air. ——— Hyrtl calls them Dr Haller "Tuta=
=mina Oculi!" The eye lashes curl upwards at their extre=
=mities.

To facilitate the motions of the eyes, they are provided with a number of muscles which move it in every possible direction, and with a velocity that can scarcely be measured. ———

To preserve the softness and trans=
=parency of the eyes, as well as to facilitate their motions, they are provided with glands of different kinds, some of which secrete an unctuous ~~liquid~~ and others a watery liquor

the Birds which soar in the air as the
Eagle &c have a third ~~eyelid~~ eyelid.
so ~~have~~ nocturnal birds. Fish have
no eye lids. The water in which they
swim, weakens the rays of light, &
serves the purpose of lids.

The Use of the Eyelids is demonst? by
the loss of sleep - pain - inflam^{n}: fears & death
which follow the loss of them. [Regulus.
also the Ophthalmia which follows an inability
to close them from inflam^{n} & swelling.
Only cured by cutting them so as to admit
this swelling by bleeding].

which are poured forth at all times in
health, at such times, & in such quantities
as they are most required. — 377. Fine p. 384 D

The Coats of the eye ~~[illegible]~~
have been divided into 3 by some, & by other physiologists.
~~[illegible]~~ — are the Conjunctiva, or Adna-
According to the latter division they =
=ta - the Sclerotica - the Cornea - the Choroidea -
- the Iris - and the Retina. —

1 The Conjunctiva - is a continuation of the anterior part of the
of the Cuticle, ~~[illegible]~~ It covers the whole eye
and connects it with the eyelids. It is in
a sound State always transparent.
2 The Sclerotica - forms what is called the
white of the eye. - It is a dense - compact
membrane extending from the Optic
nerve to the cornea. It has but few
blood vessels, and nerves, & has but
little sensibility. Some anatomists

suppose it to be a continuation of the
Dura mater, but others with more
reason suppose it to be a simple mem-
=brane accompanied only by the
pia mater continued from the Optic
Nerve. ~~C~~ In adult this continuation
of the pia mater has never been discovered.

3 The Cornea is placed in the middle of
the anterior part of the eye. It is suppo=
=sed to be a continuation of the Sclerotica,
but Dr Haller has proved them to be distinct=
membranes by their spontaneous sepa=
=ration from each other, after being ma=
=cerated in warm water. It projects
beyond the Sclerotica, and thereby assumes
a more convex appearance. ~~It is of~~

~~different tissues in people but~~

It is ~~transparent in every respect~~. Upon close examination it appears to consist of a number of lamella or plates, between each of which there is contained a small quantity of water. It is from the effusion of this water, that the eye loses a small portion of its convexity, immediately after death. The cornea is said to be destitute of blood vessels, but inflammation evidently discovers them, tho possibly, they may be branches only of the vessels of the Sclerotica. No nerves have as yet been discovered in the Cornea, - tho we often find particles of iron & glass when they penetrate, and adhere to it excite both pain & inflam[n]:

V This membrane or Uvea is covered with
a black pigment. It is paler in old
than in young people. — It is of a light
color in the cat - & in many other
animals which see best at night. Its
dark color was intended to serve
the opposite purpose of Y own Min=
=ror. It was not to reflect, but to dissi=
=cate rays of light.

4.5 The Choroidea is placed under the Sclero:
=tica, and is connected with it by numerous
intervening vessels. It consists of numerous
small Arteries, and Veins. It accompa:
=nies the Sclerotica to the Cornea where it
adheres to the Sclerotica by means of a
cellular membrane resembling a white
fringe & ch w: L is called the ciliary Circle.
From this connection, it descends down:
=wards & inwards, forming a round disk
of which the Anterior Surface is called
5 Iris from its variety of Colors, & its
Posterior Uvea — or membrana Ruyschi:
=ana. This disk has an opening in its
Middle called the pupil which L is
capable under different circumstances

of contraction & dilatation. ~~The Iris~~

The Iris is said likewise to be capable of similar contraction & Dilatation but its is probably passive only - in the contraction & dilatation of the pupil. The fluid which pass from the external margin of the Iris to the pupil are have been supposed to be muscular fibres. - they become straight when the pupil is contracted, & are drawn into serpentine folds when the pupil is dilated. Some late dissections shew the Iris to be flat & not convex &c

6. The Retina is a continuation of the Medulla from the Optic nerve, ~~which is~~ expanded into a Spherical concavity with the ~~optic~~ Tunica Choroidea. It is extremely tender, and of a mucous consistence. It embraces the vitrious

humor of the eye, and after extending itself to the ciliary processes it follows their course supported by thin arteries, untill it reaches to the Crystalline Lens to which it is intimately connected.

Lect: 14th Decem 27th 1791

The humors of the eye are three viz: the vitrious - the Crystaline - & the aqueous. It is most proper to call the Crystaline a Lens. I shall briefly describe them. or 1: The vitrious humor so called from its resemblance to melted glass fills the posterior part of the eye. It is contained in a thin pellucid membrane of a cellular fabric in the intervals of which is contained a clear liquor a little denser than water which entirely evaporates by heat. It is furnished with small blood vessels which pass thro to the

† Its use is to preserve a due softness in the Retina, and to afford support to the Crystalline Lens. —

V Its sides are softer than its middle or central parts, - from which it has been said improperly to swim in a watery liquor. This peculiarity in the structure of its Lens prevents its use from being completely imitated by Glass in experiments out of the body. For while Glass refracts the rays of light alike on its sides & center, the Lens of the eye refracts them less on its sides, than its centre, and hence it throws the image further - as to bring it to a focus on the retina. —

Crystalline Lens. +

2ly In the fore part of this Vitrious humor, appears the Crystalline Lens is ea-
=ted, behind the Uvea in an orbicular
Sinus. This Lens is more convex in
its posterior, than in its Anterior part.
It is composed of concentric plates or
Scales, connected by cellular fibres.
Between these plates is contained a
pellucid Liquor. The innermost plates of the Lens
are the closest together. The artery, coms
from the retina thro' the Vitrious hu-
=mor. The whole Lens is contained in
a strong - thick - elastic capsule - of a
pellucid membrane - from on the
fore part, and lined behind by the

It is somewhat thicker in its consis-
=tence ~~than~~ than water, & is easily
frozen. It is somewhat brackish to the
taste, and may be congealed with Spirit
of wine. I have seen it converted into
a white mass by the application
of a strong solution of sugar of Lead to the
eye in an Opthalmia. It often arises
also in Consumptive patients.
a white appearance in old people. Its
use is, to preserve the pellucidity of
the Cornea. Hence we find
it present in that coat of the eye also — to defend
the Lens & Iris from injuries, & to allow the
Iris a Space to play in. — The external

membrane of the Vitrious humor.

3 The Aqueous humor is extremely clear and fluid. It is seated between the Uvea & chrystalline Lens, & in the ~~Cavity~~ chamber which lies between the iris and Cornea. It exhales from the small Arteries of the iris, Uvea, & ciliary processes. When discharged in coughing, or by a Wound it is renewed in the Space of 24 hours. ✓

4 Having thus briefly described the Structure of the eye, I shall proceed to explain the Nature of Vision; but first I shall previously say a word upon the Nature of Light.

go on to p: 377

~~In order~~ as it connects with our subject.

surface of the eye is moistned by a ~~fluid~~ ~~secretion~~ called tears which are constantly secreted & poured out from the Lycrimal gland this 7. or 8 Ducts which open in the inside of the upper eye lid. The rapid evaporation of this fluid in hot Countries occasions the most distressing Opthalmias - ~~the~~ a Defect of its evaporation which takes place in wet weather occasions involuntary tears. — They become acid by an inflame:- of the eyes. What is not required to moisten the eyes nor in weeping is absorbed by the puncta Lacrymalia, & conveyed into the Lacrymal Sac from whence they pass thro the nasal canal into the nose.

~~from to the~~

Turn back to 362 v

~~Electron is~~ I believe light to consist
of Particles, and that it proceeds in every
part of our Solar System. ~~It appears~~
~~produce vision~~ It is invisible in the
night only because it is in a quiescent
State. Motion is essential to its producing
vision - and
to be com
rays of the sun. — It is necessary to
stagger our faith, or to fatigue our
imaginations by supposing that these
solar rays travel thirty millions of
leagues
~~Earth~~ in 7, or eight minutes, or four
millions of leagues in a minute. By
in order to illuminate our globe!
no means, I would rather suppose
that they act by imparting motion

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to the particles of light which already
exist in the air. — In explaining
muscular motion I supposed the
brain to be the origin of all motion,
influence, but I did not admit
necessity of an influx from the
brain in every act of muscular
Revolution. I supposed the motion of
the nerves in the extremity of the body
which was the vehicle of motion only
to be moved by a motion began in the
brain, and that the matter which
conveyed these motions was stationary
in every part of the nervous system.
In like manner may it not sup-
-pose the spirit to with respect to

light to be a kind of brain of our
Solar System, and that it acts only
by imparting motion to those rays
which are connected with its substance,
which rays by a law of motion for=
=merly mentioned communicate it,
perhaps in less than 7 or 8 minutes,
probably
- in the twinkling of an eye to ~~every~~
~~part of~~ our globe. ~~In the~~ But further,
during the repose of the brain - sensation
& motion are every where
~~is every~~ suspended, - but it ~~is still exist~~
the matter & properties
on which they depend, still exist
in the extremities of the muscular
fibres. ~~Like the particles of light they~~
~~are only in a process~~ In like man=
=ner, during the absence (or as an
Indian would express it) during the

upon of the sun, the particles of light or matter
which are diffused over the surface of
the globe, & probably this all our solar
system are suspended in this operation.
— They are deprived of motion, but they
still exist, and wait only for the return
or fresh excitement of the sun to restore
to them the properties of motion and
light. — Ou certain stimuli restore
the sensation & motion in the extremities
& the organ of the brain, so certain
during the repose of the
artificial lights such as fires - Lamps -
and candles or by exciting motion
in the particles of light, supply the
absence within a certain space, of the great
luminary of day. and light. —

It would be easy to go on & multiply
Analogies of the resemblance ~~of light~~ be-
tween the manner in which it is possible for light and
muscular motion A to be produced.
The Author of Nature seems to have
created all things as it were by a
single instrument, and the further
we push our inquiries into the Natural
- the Moral - & the intellectual worlds,
the more we observe the operations
in each of them to be carried on by
the same simple principles. Eg: the
absence of light is darkness in the Natu-
ral - the absence of good is evil in the
moral - and the absence of knowledge
is ignorance in the intellectual world.

† Exodus 25. 9. 40. & Numbers 8. 4

Here we observe three great effects to be
produced in the same simple manner.
~~all the books of the Caution are full~~
of similar examples of Unity, and
simplicity appear in all the works
of the great Creator. — He seems in
the Mosaic law to work of Creation
to have delighted in precedents, or in
following his own sublime & original
examples of perfection. He created the
first man - after his own image.
and he furnished Moses with a
pattern of all the furniture of the
tabernacle and the altar which he
afterwards built in the wilderness.
But my theory of light is far from
being simply conjectural, or founded

only on the analogy of the functions
of the ~~Brain~~ Brain - and other parts of the
Nervous System. - In the ~~Mosaic~~ Mos.
of the Creation given by Moses, we find
Light was formed - before the Sun,
and that it was by means of the
Sun that the relative terms of day
and night were introduced. - I say
relative terms - for there is no such
thing as absolute darkness, except
here ~~before~~ that ~~darkness~~ supernatural
darkness which was inflicted upon
Egypt and which was perceptable
to the sense of touch. ~~to have been~~
~~of~~, for we read Exodus X & 21 that it
was darkness that could be felt.

That light is relative I prove from its existing ~~as a~~ during the absence of the Sun. hence we find that mountainous regions see as perfectly during the night as we do at brown day. We are as yet ignorant of the lowest limits of light as we are of the lowest degrees of heat —, for what is call Cold is only a diminution ~~of~~ of heat, just as what I called Darkness was only a diminution of light. — Allow me another Analogy. ~~In~~ Darkness is light in a latent state. It is converted into visible light by a sudden impulse from the sun. — ~~I am the~~ Light then you see Gent: according to my theory depends upon the same

simple cause as animal life viz

Stimulus and motion. They appear

to be ~~the active~~ the two most active principles ~~agents~~

in the Universe. —

But from where do we derive the

relative light of midnight – if light is

produced only by an impulse from the

~~the light~~ –

Sun upon certain particles of light.

~~– I answer from the sun and Moon~~

I answer, from the moon & fixed stars,

and in the northern Regions from

the Aurora Borealis which is seldom

absent during the long nights of ~~Winter~~

those northern Countries. Perhaps too

sometimes analogous to fermentation

takes place in the matter of light.

rays of

v. Why does not the light which enters a dark room by a key hole fill it with light? — It only produces light on those particles of the matter of light which lie in its way. —

when a Stick on fire is turned round
with a quick hand, it produces in
the ~~eye Impression~~ eye a sensation of a fiery
circle. This is occasioned by the sensation
being continued a short time after
the impression has ceased to act upon
the Optic nerve. It continues in other instances
~~a~~ minutes. & even half an hour.
may not a small degree of Motion
be left in the matter of light after
the Sun has ceased to act upon it.

~~Any~~ The doctrine which I have
offered to you does not militate in the
least against the ~~old opinion of the~~
Sun being a great body of light-
or the ~~only~~ great Source of light.

I believe it to be both, but that it
produces light in our globe - not by
diffusing an aura of particles to
us every day, but simply by setting
these particles in motion with wh
the surface of
our globe & perhaps our whole planetary
system is filled. —
are always

5
Does not the feeble and partial light
which is produced by artificial means
during the absence of repose of the brain ch
answer to the sensations & motions w.
are excited in the nerves & muscles
during the suspension of the powers of
the brain in Sleep and in diseases, as well as
to the sensations & motions which are produced
in those Animals which are devoid of
brains. 2 Does it not then something
like a vis insita in the particles or

V If this Amount of the production of
light be admitted, it will relieve us from
all the ~~difficulties~~ Controversy about the
diminution of the Sun by shining. There
will be no more occasion to suppose that
it ~~lop~~ is lopped by ~~the~~ producing light that
than the brain is lopped in its size or
~~from~~ weight by producing sensation ~~or~~
& motion in the extremities of the body.

matter of light ? — V

~~Thus particularly~~ this theory will receive some support from ~~the~~ attending to the history of Sounds. The body which sound as I shall say hereafter is produced by vibrations or undulations communicated to the air by an impression given to a sonorous body. — Nothing is emitted or discharged from this body. It does not change its place. It trembles only, — and its tremors move successive contiguous particles of air as far as ~~its~~ these tremors extend. Who ever supposed the last particle of air that was moved came from the sonorous body? — Why then should we suppose the

V They must all three be resolved into an

~~an~~ institution of the Deity.

matter of light to come to us every morning
from the Sun? It is sufficient for our
purpose if the Sun give ~~it~~ the same
motion to the matter of light which a luminous body gives
to distant particles of air. —

Do you ask, how motion creates
light? ~~by shewing the figure~~ I shall an-
swer it by asking two other questions.
How does the brain produce sensation &
motion in matter? and how does vi-
bration in the air produce Sound?

Do you ask how light is altered in
its direction as I shall say
presently in passing this a dense
medium such as water or glass? I
answer — just as is Sound altered in

V You see then that I consider
Light - like Life - as only a quality,
produced by like life by a stimulus
acting upon a peculiar kind of matter.
- The sun with respect to the matter of light
seems to occupy the same rank as
a primary Stimulus, that dephlogisticated
Air does in producing Animal life.

its course by the form of the Medium
thro' which it passes, ~~or against which it strikes.~~

Do you ask how ~~it is~~ are the
particles of light reflected from shining
bodies - I answer just as sounds are
reflected from solid bodies when they pro-
duce an echo. — V

But it is time to quit this subject,
Perhaps I have only exposed my temerity
in ~~explaining~~ delivering these opinions upon it - for
in so doing I have ventured to oppose a
part of Sir Isaac Newton's ~~immortal~~
theory of light. ~~and Colors~~. - You will
pardon me if I am mistaken, especially
when you reflect that the doctrine I
have advanced is calculated to enlarge our ideas of the
importantness of the Science of Physiology,

V The

by shewing us that it may be made
a key to unlock some of the most abstruse
mysteries of Nature] —

Of ~~[illegible]~~ fine as this
matter of light is — it has not escaped
an Analysis. — Sir Isaac Newton ~~[illegible]~~
us by means of a prism that
has taught ~~[illegible]~~ it consists of seven
different species of matter, each of which
is capable under peculiar circumstances
of exciting in the mind ~~[illegible]~~ seven diffe-
-rent ideas of what is called Color.
yellow -
These Colors are Red - orange - Green -
Blue - Indigo - ~~[illegible]~~ - and violet. — They may easily
be remembered by taking the initial letter ~~[illegible]~~ of
each color invented, and throwing them
into a word. — This word will be Vibgyor.

all the Variety of Colors in
V ~~Different Substances~~ Natured
Art are produced by different combinations
of the seven primitive or original Colors
which have been mentioned. The differenc
in the Color of any body ~~in proportion~~ depends
upon its peculiarity of Structure ~~on~~ by which
it is disposed to reflect one set of rays rather
~~The~~ than Another. ~~You see~~ Here that I consider
~~would be~~ ~~the most~~ ~~Color~~
Color as a Quality of Matter. ~~The~~
~~The~~ The Sensation of it ~~only~~ exists only
~~in the~~ ~~Mind~~; ~~but~~ in the mind,
but
~~Color~~ if there were no vision
and no Mind, the Substances which reflect all the
different Colors would still have a material existence. The
~~opinion~~ was held by Bishop Berkley &
contrary of this Opinion
~~supported by~~ ~~by~~ ~~who~~
~~accurately by those who~~ formed ~~of~~ ~~the~~ ~~Infidelity~~

a body is called red when it reflects red rays only - it is called blue, when it reflects blue rays only - and so on of all the other colors. - A body is said to be White - When it reflects all the seven species of rays at once - and black when it absorbs or extinguishes them all. A body which allows all the rays to pass thro' it is said to be transparent & a body which extinguishes one part and reflects the other is said to be opaque. go to 383 I Dark Side -

When the Rays of light strike a body without entering it they are said to be reflected. They strike bodies in different directions, but there is a perfect Uniformity in this manner of reflection.

absurdly
Supposed that the Matter which existed
all our Sensations had no real qualities
or Shape, but existed only in our Minds.
The Sugar - a rose - and the the blue color
of the Sky, to have as much a real ex=
=istence as the human body, or a Spirit.
It is true the Sweetness of Sugar - the fragrance
of the rose - and the loveliness of the blue
expanse of heaven, are all relative terms
& could not
there no corporeal bodies to a in whose
senses they could have excited the Sensations
that I have ascribed to them. They existed
a capacity only of exciting pleasure & to esteem
and require the concurrence of bodily Senses to render
them known, but they would have existed with the
capacity of creating those Sensations if a human
body had never existed to enjoy them. A house
would have been a house to the end of time,

Hence it has been repeatedly demon-
-strated that the angle of their reflection is
always equal to their angle of incidence,
or in other words, to the angle they make
in falling upon the body from
which they are reflected. —

Again - When the Rays of light are
altered or
broken in this passage thro a body, they
are said to be refracted. — This refraction
appears when the rays enter this body obliquely, it
different according as the rays
pass from a thin into a Dense Medium,
or from a dense into a thin Medium.

Eg: When they pass from air into Water,
they are refracted towards a perpendicular
Drawn in the water to the point of its pen-
-etration where the light falls, - but when they

although it had never been inhabited, and a
Gun would have been an instrument
of Death. although it never had been employed
in taking away the life of a single
animal. This gross error of Dr Berkleys
is the natural Offspring of a belief in
animal life originating in an impulse given
to the body by the Soul, or mind,
the mind
for if be capable of beginning life, or
bodily existence, no Wonder a power
is given to it of Annihilating
all bodily, or material existences, and
occupying alone all the existence.
in form and Qualities upon our globe.

paſs from water into air, they are
refracted in a contrary direction to the
perpendicular drawn in the air thro' w:
it paſes. - go on to × below

To when I ſpeak of Rays paſsing thro'
bodies light: I conform to the common
language of describing the laws of light,
but I beg to be understood here that I mean
only no more than motion communi-
=cated to the matter of light which pre-
=viously existed upon the surfaces from
which it is reflected, or in the Mediums
thro which it paſes with, or without
refraction. T turn over to 381. A

× The Rays of Light paſs thro' Mediums
of the same finality differently according

to their focus. ~~They are further~~ refracted in

different perpendiculars or directions accor=

=ding as the ~~M~~ medium thro' which ~~they pass~~ they

is Concave, or Convex. — and ~~they~~ meet sooner in a point, or diverge further

from a point, according to the greater or

less concavity or convexity of the ~~thro' which they pass~~ medium

A Thus I have delivered you a few gene=

=ral propositions upon the subject of

& Colors, and the laws of light.

They will be made more plain, and

intelligible to you by experiments &

diagrams by the Professor of N. Philosophy.

I have said no more upon them

than was necessary to explain the nature

of Vision. –

The application of these facts to Vision will now appear simple to you. The rays of light fall at all times during the day, in various directions upon the Cornea of the eye. Some of these are reflected back from it – viz: all such as fall on the membrane in a greater angle than 40°: – Those which enter the Cornea, undergo a small refraction in the Cornea & Aqueous humor. – They undergo refraction still greater in the Crystalline lens, – and vitrious humor, and finally they meet in a point or focus upon a small part of the Retina where they paint an image of the Object from which the rays of light are reflected, and which is the Object of Vision. all

Those rays which the humors of the eye could not concentrate, or refract into a

focus upon the retina are suffocated or lost in the black point which lies upon the area of the ciliary processes. —

I have said that the Retina is the point in which the visual rays meet in a focus so as produce vision. I am aware however that Mr. Mariotte, Le Cat and some other Physiologists place vision in the Tunica Choroidea. The principal argument in favor of this opinion is, that the Spot where the optic nerve enters the retina has no vision, and that on that Spot, there is a defect of the coat of Choroidea. But this proves nothing. The Retina we know is a most sensible nervous medulla, whereas the Choroides possesses but few nerves. The Retina

V Where the Optic nerve enters it, we find the Nerve enters, not in a line with its Axis, but near the Nose, by which means the Picture of no Object can fall at the same time on both those insensible parts.

An exact Shape in the humors of the eye is necessary to produce just Vision. If the Rays of light are too flat, the they become brought to a focus beyond the retina, but if those humors become too convex, the rays are brought to a focus before they reach the retina. - In both cases Vision becomes indistinct. Old men are subject to the former disease of the eye. Children are all born subject to the latter, but it goes off as the eye flattens: which it does as they advance in life. Many persons adult are subject to it. They are called Myopes. They relieve themselves by holding the Object of Vision near to the eye, or by a concave glasses which prevent the rays of light from meeting in a focus before they

moreover in all animals is as uniform in its shape and properties as Vision itself whereas there is a great Variety in the form of the Choroides in different Animals. Lest any inconvenience should follow from the insensibility of the Retina at the Spot

V

~~O~~ The Eye possesses a power of accommodating itself to near and distant Objects of vision. This has been supposed to be effected by the projection, or retraction of the Crystalline Lens, but more accurate Observations prove that the Lens is immovably ~~does not move~~ ~~out of its~~ fixed with respect to a forward, or backward motion, and that the ~~pupil~~ Iris only is contracted and dilated according to the distance of Objects. It is contracted in viewing near Objects, and dilated ~~expanded~~ in contracted viewing distant Objects, and Vice Versa. ——— This motion in the pupil is produced by the ~~Iris of Elongation~~

reach the retina. The persons who have flat humors are called Presbyopes. They relieve themselves by placing the Object at a greater Distance, or by convex glasses, which bring the rays of light th w: the object of vision on them to a focus before they pass the retina, only [illegible] which

The Myopes see in the dark only. V[illegible] to 385 N

+ This is true in the ordinary state of the eye, but Dr Monro mentions two cases of internal Dropsy of the brain in which the eye contracted with darkness, & expanded with light.

Iris of the Iris becoming straight, or being drawn into folds in the manner formerly mentioned.

The pupil moreover contracts & expands in proportion to the degrees of light thro' which it views all Objects. — ~~The~~ It contracts when we go suddenly into an illuminated room, and it expands when we leave such a room and go into a dark place. The greater the darkness, the greater the expansion of the pupil. The Light which is necessary for the purposes of life is not only relative in different Animals, but likewise in Man, - hence we find accounts of persons who have been gradually able to see, and even to read distinctly in dungeons where at first they were unable to distinguish the largest Objects around them. The sudden

V That vision is most perfect in which we
we are able to read a book placed at the
distance of one foot from the eyes. —

There is another peculiarity in Vision
which deserves our notice. Some men
who possess an apparently perfect eye,
are unable to distinguish any, and those
but a part of the seven primitive colors.
a Student in the College of Glasgow
could not discover his red gown, when
laid upon the green grass. Mr Dalton
in the 5th Volume of the Manchester
Memoirs ascribes this peculiarity
in Vision to the Vitreous humor being
Coloured, so as to Absorb some rays,
and transmit others. I would rather
suppose it was occasioned by a

Disease in a portion or filament of
the nerve which commonly transmits
the rays that could not be seen.

Different Colors are induced by closing & rubbing
the eyes. This depends upon the same
parts of the retina being stimulated
which had been in the habit of produc=
=ing the perceptions of those
Colors.

Squinting is occasioned by a weakness
of the muscles which move the eyes,
or eye. It is sometimes induced by viewing Objects
sideways. This was the case with
the Revd. Mr Whitefield. His mother
when he was a child placed a black
patch to cover a little sore upon the
side of his nose. By banning one of his
eyes in the direction of that patch

he ~~lost~~ lost an equable power
over its Muscles, and was afterwards
Squinted with it. He was called
by his enemies from this penlia=
=rity in his Vision a Squintess.
Squinting is likewise induced by
bringing Objects too near the eyes,
and by confining Vision exclusively
to one eye and thus preventing the
habit of Association in the Actions
of both eyes.

The eye possesses a power of accommo=
=dating itself to near and distant Objects
of Vision. This has been supposed to
be effected by the projection, or retrac=
=tion of the ~~Iris~~ Crystalline Lens, but
more accurate Observations prove

that the Lens is immoveably fixed
with respect to a forward or backward
motion, and that the pupil only is
contracted and dilated according to the
distance of Objects. It is contracted in
viewing near Objects, and dilated in
viewing such as are distant. This
motion in the pupil is produced by
the Stria of the Iris ~~being~~ becoming
straight, or being drawn into folds
in the manner formerly mentioned.

Hydrocephalus in tissues in which the eye contracted with darkness, and expanded with light. The case of the same kind sent from another came was once communicated to the Liz Dr Southe. But against

‡ There is another peculiarity in vision which deserves our notice. Some men who possess a perfect perception are unable to distinguish the ~~the~~ any of its Colors. Others only a part of the Primitive Colors. A Student of Glasgow could not discover so

V In this kind the passions discover them-

selves by the contraction and dilatation of the pupil. —

This red power when laid on the green

grass, exept by accident. Dr Dalton in the

5th Vol: of the manchester memoirs ascribes

it to the Vitreous humor being Colored,

so as to absorb those rays & transmit

Others. I should rather suppose it was owing

to a Diseased of the portion or filament of nerve which

its true Color is. Return to p: 384 ‡

commonly transmit the rays that could not be seen. ‡

Question is occasioned by such a weakness

impression of light after being long depri-
-ved of it, and the sudden abstraction of
light, are both equally unfriendly
to the healthy exercise of Vision. It is for
this reason probably that the light of the
Morning, and the darkness of night are
let in upon us in a manner so gradual as
to give no pain to the eye, & never to
injure Vision. —

All ~~these~~ motions of the Iris & pupil
appear to be instinctive in the
human Species. But these are under
the Command of the Will in some
animals — particularly in the parrot.
These ~~motions~~ Motions of the pupils are important in certain
diseases as they shew the state of the

which scope or from viewing Objects
=in the muscles of the eyes, as that they move
in a Side Direction - so as to gain field - or bringing objects too
near the eyes - as is often the case with young persons +
confined to One eye - from its not being sufficiently
used in concert with its fellow = Return to p 384 eye.

IV Infants do not possess for some weeks a power
of moving their eyes only to the right and
left. They are unable to
look upwards. Their first direction of
their eyes is generally towards the light.

V I formerly spoke of the sympathy between
the eyes & the stomach. It discovers this
sympathy in the action of
of Opium upon Vision. It produces delight-
-ful or ghastly images according to the
Dose that has been taken.

Children seldom see correctly until 3 weeks or a month
after birth owing to the greater thickness of the Cornea,
& a less quantity of aqueous humor in the eye than is
proper for vision. The Cornea measures 1 line in a new
born infant, & but $\frac{1}{8}$ of a line in a grown person. For
some weeks after birth, it can only move its eyes
to the right and left. It is unable to look upwards.
Its eyes are first attracted by
light.

Retina and Brain with respect to sensibi-
-lity and oppression. They moreover
their capillaries
Thirst ~~to contain~~ become turgid in the
here it is generally dilated in Chronic diseases.
System & particularly the presence of
Phthisis pulmonis according to Dr Withering

It is remarkable that grey or blue
eyes are most common in Northern,
& black or dark coloured eyes most
common in Southern Countries. A
wise reason may be given for this
difference of color
~~peculiarity~~ in the eye. The blue
is
& grey eye most accommodated
a
to the scanty light of Northern, &
the black eye to the redundant rays
of a Southern Sky. — Where it otherwise
imperfect vision or blindness

would be more universal from the feeble
impression of light in the former, & the two pow-
-erful impression of it in the latter case.
& northern
The Indians who inhabit the Middle regions
of the United States are the only exception
that I know to this remark. They have
in general black eyes, altho they live
northern
in a country. But I suspect they
are not the aborigines of the latitudes
they now occupy. They appear to
have wandered Along the shores of the
Mesisipi from South America.
— The remark therefore will stand good
Untill we are informed that the Esquimaux
Indians, and the nations to the North of
them have eyes of the
same color with the Indians who

live in the middle regions of North America.
— I suspect that it will be found that
they have the grey, or blue eye of all
other northern nations. —

It is a curious fact that all objects
are painted in an inverted position on
the retina. It has been supposed
that objects appear to the mind original-
-ly as they are painted on the retina, but
that we learn from habit to give
them a just position, but this is false,
an erroneous
opinion,
for men who have been couched for
Cataracts which they had from infancy,
see things as we do, with
respect to position, the instant they
receive their sight. The position
inverted,

v that are made upon them all.
We see more distinctly with two
eyes than =

position is both natural & necessary, for
as the Mind follows each ray in its
course from the part of the retina w.h
is stimulated by it, it places Objects in
their true order. The rays which strike
the lower part of the eye lead the mind
upwards and vice versa. —— Eg:

It is equally curious ~~that~~ that with
two eyes & two retinas ~~the~~ the ~~two~~ impressions
made on each of them, we see but one
Object. This too has been erroneously
ascribed to habit. I explain it thus.

From two impressions of equal force,
we can have but one sensation. Even
those
insects which have eight eyes, have but
One sensation from all the impressions

p 390 cont'd

= with One. The right eye is chiefly employed in Vision. But small as the apistance is which the eyes give to each Other, Vision is less true, especially with respect to Distance & Direction with One eye than with two. This is Obvious in persons with One eye when they attempt to Snuff a Candle, or to pour Wine into a Glass. They generally mistake those Objects, Until time and habit have taught them Accuracy. ~~Latitude~~ With respect to Acuteness & correctness of Vision, it is more perfect ~~than~~ with One eye, than with both, hence Watchmakers, and Astronomers look with One eye

thro their respective glasses.

I have several times mentioned the Dependance of the Senses upon each other. Vision owes much to the sense of touch. Without it we should be unable to distinguish Distance, figure and motion. This has been proved by many experiments. The young man recently couched by Cheselden imagined every Object he saw touched his eyes. Other persons recently restored to their sight (who had never seen before) have thought large Objects small, Square Objects round, and moving Objects, stationary. Philosophy therefore confirms the truth of the history of the Cure of a man born Blind

recorded in the new testament.
He saw, when his sight was restored,
men — not as they are — but as
trees, that is as unlike to men as
trees: for he had no doubt when
a ~~lad~~ boy often handled, & clim=
=bed trees, and had thereby formed
an Obscure idea of their Dimensions
and height.

From what has been said we
are able to answer the following
questions.

Why do some Animals see to per=
=fectly in the dark? I answer — be=
=cause they have a large dilatable
pupil, a shining Choroides, and an
exquisitely sensible retina.

Why do we feel pain when we
are brought out of a Dark room
into the meredian or a glaring
light? — because the pupil having
been greatly dilated, ~~and~~ is sudden=
=ly exposed to too great a quantity
of light which stimulates the retina
so forcibly as to give pain.

Why do we lose our sight when
suddenly brought from a strong to
a weak light? because the retina
is incapable of being ~~suddenly~~ moved by a
weak stimulus after being exposed to
a strong One. —

Why is the eye rendered soft &
languishing by looking at black

O and never to read by ~~to~~ excessive or scanty light — nor to read constantly one kind of print — nor Books printed on very white paper.

3ly to avoid keeping the eye in washing the face. It tends to flatten the ~~Lens~~ humours of the eye & thereby to lessen light — by ~~rod~~ producing spasmatively the disease of Presbyopes. 4 By blacking the eyelids, ~~and~~ or by combing over the forehead; vision ~~the~~ is improved. Those black matters absorb certain rays of light & prevent the eye being overcharged with them. 5th By the early use of Spectacles, as soon as the sight begins to decay. 6th ~~=~~ ~~as~~ as below

~~=~~ 5th Mr Roscoe mentions an instance of the sight being improved by the practice of examining the flowers of plants in order to discover their relations to each other. 6th as above ~~=~~

2ly By reading or writing before day instead of after light. Lord Erskine and Wm Rowle. This eyes injured by reading by candle light after light. X